

An Illustrated Angiosperm Flora of Cerrado and Riparian Forest, São Carlos, Brazil

Catia Urbanetz^{1*}, Gustavo Hiroaki Shimizu² and Maria Inês Salgueiro Lima³

1 Embrapa Pantanal. Rua 21 de Setembro, 1880. Caixa Postal 109, CEP 79320-900. Corumbá, MS, Brazil.

2 Universidade Estadual de Campinas, Instituto de Biologia, Departamento de Biologia Vegetal, Laboratório de Taxonomia. Rua Monteiro Lobato, 970. Caixa Postal 6109. CEP 13083-970. Campinas, SP, Brazil.

3 Universidade Federal de São Carlos, Centro de Ciências Biológicas e da Saúde, Departamento de Botânica, Laboratório de Sistemática e Ecologia Química. Rodovia Washington Luís, km 235. Caixa Postal 676. CEP 13565-905. São Carlos, SP, Brazil.

* Corresponding author. E-mail: catia.urbanetz@embrapa.br

ABSTRACT: We surveyed a Cerrado and Riparian Forest vegetation area located at São Carlos Federal University (21°58' S, 47°51' W). The objective of the survey was to provide a full inventory of the area's angiosperm flora. This inventory was conducted in a region in which few remnants of Cerrado and Riparian Forest are left because of the destruction of these habitats to provide land for sugar cane and citrus cultivation. We identified 188 species. These species belong to 140 genera and 55 families. We obtained images of 117 species, including details of inflorescences, flowers and fruits, to support our identifications. These results highlight the importance of the preservation of this reserve because the area offers a species-rich flora in a location where few fragments of native vegetation exist and because the area could be of interest for establishing ecological corridors.

INTRODUCTION

The formation universally named savanna is designated as “cerrado” in Brazil in its broad sense. This term appears in various forms because it refers to physiognomy and not to floristic composition or ecological characteristics (Joly *et al.* 1999). The Cerrado *sensu lato* is a vegetation type dominant in the central region of the Brazilian Central Plateau (Eiten 1972). Its savannic forms (“campo sujo”, “campo cerrado”, and “cerrado *sensu stricto*”) represent ecotones between two extreme forms: the forest form (“cerradão”) and the grassland form (“campo limpo”). These different forms may have a wide range of intermediate physiognomic and structural characteristics determined by various conditions, such as geomorphology, topography, the physical and chemical qualities of the soil, the frequency of fires, or grazing (Coutinho 1978).

Riparian Forests cross the Cerrado region from northwest to southeast and occur under different climatic, topographic, and edaphic conditions. The definition of this vegetation form requires only a forest structure with a long and narrow extension (Haridasan 1998). These forests are characterised by their association with the watercourses. The different physiognomies of this vegetation are associated with relief variation and with the corresponding soil classes (Silva Júnior *et al.* 1998). Riparian forests are floristically and structurally heterogeneous. Most of the forest species are habitat generalists and also occur in the cerrado (*sensu stricto*), although there are endemic species (Oliveira-Filho and Ratter 1995). The floristic composition of the riparian forests from the western and northern cerrado region most closely resembles that of the Amazonian Rain Forests (Oliveira-Filho and Ratter 1995). In contrast, the riparian forests from the central and southern Cerrado region most closely resemble the montane semideciduous forests in southeastern Brazil.

The Riparian Forests act as a physical barrier. They

regulate the exchange processes between terrestrial and aquatic systems and serve to develop favourable conditions for infiltration (Rezende 1998). The importance of these functions lies in reducing the possibility of the contamination of watercourses by sediments, fertiliser residues, and pesticides carried by runoff water on the ground. This ecosystem behaves as an excellent consumer and nutrient buffer for the runoff from neighbouring agroecosystems (Rezende 1998).

Cerrado is a biodiversity hotspot (Myers *et al.* 2000), with more than 12.000 vascular plant species. About 35% of these species are endemics (Mendonça *et al.* 2008). Only 1% of the original cerrado vegetation remains. It is estimated that approximately 1 million hectare of the marginal areas of watercourses in São Paulo state lack any riparian vegetation (SMA 2007). Approximately 7% of the native plant cover remains in the São Carlos region. For this reason, this area was classified as having a high priority for the establishment of ecological corridors linking fragments (Rodrigues *et al.* 2008) and having a very high or extreme priority for conducting biological surveys (Joly *et al.* 2010).

Thus, the aim of this study was to conduct a floristic survey of the angiosperm species from a fragment of cerrado and riparian forest in the São Carlos region. The information from this survey can be useful to support various projects.

MATERIALS AND METHODS

Study site

The São Carlos Federal University campus (UFSCar; 21°58' S to 22°00' S, 47°51' W to 47°52' W), São Paulo state, southeastern Brazil, has an area of 672 ha (Figure 1). The area originally belonged to Trancham Farm and was acquired by the city in 1968. The main types of vegetation found on the campus are cerrado *sensu stricto*,

eucalyptus forest, and riparian forest. These vegetation types represent 20% of the campus area. One of these areas, comprising 124.68 ha and located north of the campus, includes cerrado *sensu stricto* as the predominant vegetation, a riparian forest and a marsh area. The regional climate is Cwa (Köppen 1948), a warm temperate climate with wet summers and dry winters. The annual rainfall is 1,339 mm, and the mean annual temperature is 22.1°C. The local altitude is approximately 860 m.

The human-modified cerrado represents the major portion of the conservation area of UFSCar. The landscape is rich in species, and the striking physiognomic aspects of this vegetation type are well represented in the reserve. The herb layer consists primarily of grasses, including the invasive species *Urochloa decumbens* (Stapf) R.D.Webster, *Eragrostis plana* Nees, and *Melinis minutiflora* P.Beauv. The soil found in the cerrado, a red-yellow alic latosol, has a sandy texture and is very deep.

Within the cerrado *sensu stricto*, a riparian forest accompanies the course of Fazzari stream (Figure 1). The stream originates from the impoundment of the water from two springs. The forest has a herb-shrub layer composed primarily of a large number of fern species. The tree layer is composed of a 20 m high canopy. The canopy decreases in height at the edge of the forest, where the cerrado *sensu stricto* formation begins. Alic low humic gley soils are found in the areas adjacent to the stream. These soils have excessive aluminium saturation and poor drainage due to their proximity to water bodies and the superficial position of the groundwater.

Data collection

We made monthly collections for 2 years of the reproductive and vegetative structures of tree, shrub, herb and climber species in an unsystematic manner along a path established for educational purposes and known as “Trilha da Natureza (Nature Trail)”. The path extends about 1100 m through a portion of the area’s cerrado and riparian forest vegetation (Figure 1). The material

collected was deposited in the HUFSCar herbarium of the Botany Department, São Carlos Federal University.

We obtained images with the aid of a system composed of a video camera coupled to a stereoscopic microscope, a computer and a scanner. We used Image-Pro Plus software to obtain and edit the images. The images were obtained by scanning photographs taken at the study site or from herbarium material.

We consulted the HUFSCar and UEC herbaria as well as specialists and botanical literature for species identification. We used the APG III (2009) classification system.

RESULTS AND DISCUSSION

We found a total of 188 species, belonging to 140 genera and 55 families of angiosperms (Tables 1 and 2). Of these species, only nine were found in both types of vegetation (Tables 1 and 2). We made 13 plates with images of the branches and details of the flowers and fruits of 117 species from the cerrado and Riparian Forest to support the identification of species from the study site or from other places where they occur (Figures 2-14b).

In the cerrado, we found 167 species, 47 families and 127 genera. The richest genera were *Vernonia* (7 species), *Erythroxylum* and *Solanum* (5), and *Banisteriopsis* (4). The most representative families were Fabaceae (29 species), Asteraceae (20), Malpighiaceae (12), Bignoniaceae (10), Melastomataceae (9), Rubiaceae (8), Erythroxylaceae, Myrtaceae and Solanaceae (5), Annonaceae, Apocynaceae and Poaceae (4). These families comprise 69% of the total number of species collected in the cerrado. Among the species found, 64 are shrubs, 44 are trees, 22 are herbs, 20 are shrubs or trees, 14 are climbers, two are palms and one is a herb or shrub. For certain species not found in reproductive condition during the collection period, HUFSCar herbarium data were included.

We compared this cerrado survey with a previous survey conducted in Pratânia (Carvalho *et al.* 2010), São Paulo state, approximately 70 km from the city of São Carlos. A total of 119 angiosperm species were recorded for Pratânia. The total of 167 species found in the UFSCar reserve represents a higher species richness. A total of 36 species were common to both areas. The Jaccard similarity coefficient for the two areas was 0.1974. This value indicates a low similarity between the areas. Fabaceae and Asteraceae were the richest families for both locations. Asteraceae is highly typical of cerrado areas, primarily in the shrub and herb layers (Ratter *et al.* 1997). However, only four species of Asteraceae (14%) occurred in both areas. Despite the occurrence of frequent species of Asteraceae in São Paulo state, there is a high proportion of rare or exclusive species (Almeida *et al.* 2005). This high proportion is also characteristic of the study site. This finding highlights the importance of the preservation of the site.

We found 30 species, belonging to 26 genera and 22 families, in the Riparian Forest located along Fazzari stream (Table 2). The richest families were Primulaceae (4 species) and Meliaceae (3 species). The richest genus was *Myrsine* (4 species).

The species *Aechmea bromeliifolia*, *Campomanesia pubescens*, *Cissus subrhomboidea*, *Copaifera langsdorffii*,

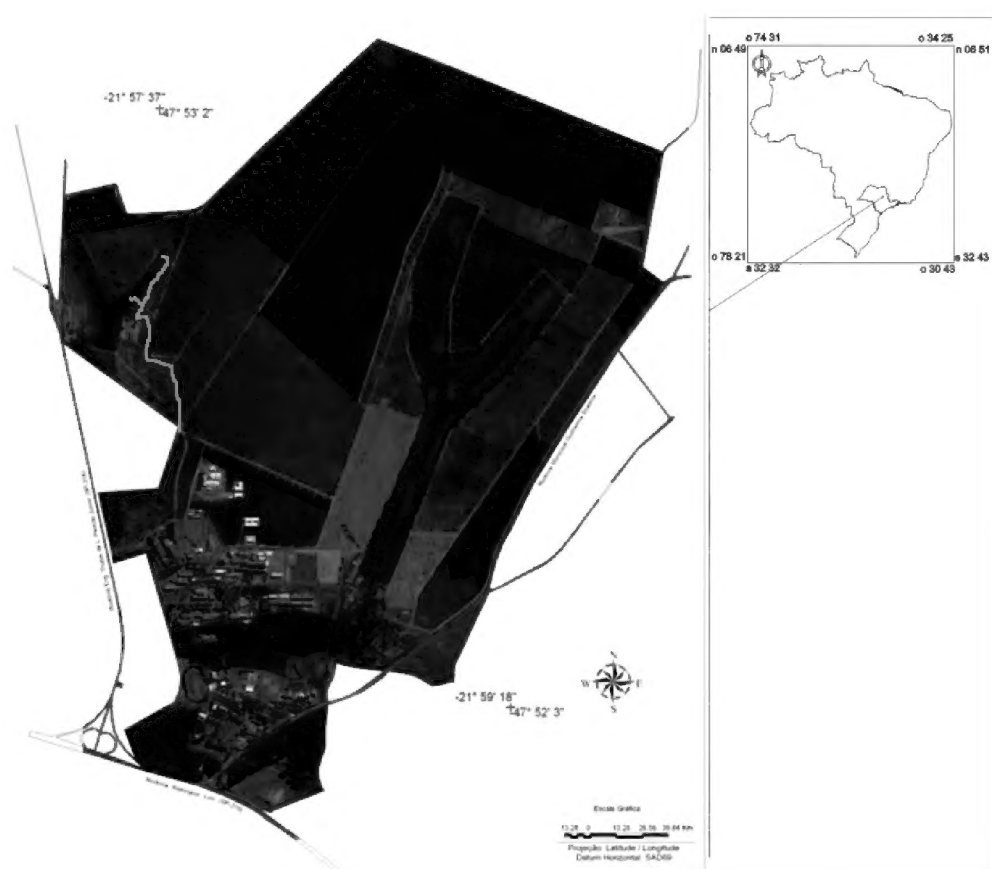


FIGURE 1. Map and satellite image of Universidade Federal de São Carlos localization from Google Earth program. The brown line represents the path established for educational purposes known as “Trilha da Natureza”. The path extends through a portion of cerrado and riparian forest vegetation.

Dalbergia miscolobium, *Ocotea pulchella*, *Pera glabrata*, *Styrax camporum*, and *Vochysia tucanorum* are habitat generalists. They were collected in both Riparian Forest and cerrado vegetation (Tables 1 and 2). *Copaifera langsdorffii* is widely distributed in Paraná semi-deciduous forests but extends to the Cerrado Province, occurs in a wide array of soil types, and appears to follow the Aw and Cw (Köppen 1948) climate types (Oliveira Filho and Ratter 1995). In contrast, the exclusive species, such as *Hedyosmum brasiliense*, *Hieronyma alchorneoides*, *Calophyllum brasiliense*, *Magnolia ovata*, and *Drimys brasiliensis*, appear to depend on high soil moisture (Oliveira Filho and Ratter

1995). *Drimys brasiliensis* is also strongly associated with altitudes above 1,000 m (Oliveira Filho and Ratter 1995) but was found at the local altitude of 860 m. The Riparian Forest of Fazzari stream, although restricted to a narrow range (50 to 100 m wide) and showing a lower richness than the cerrado, plays an important role in the maintenance of the macroinvertebrate and fish fauna (Barbieri 1992; Roque et al. 2003). Furthermore, studies of mammals and birds conducted in this area show the importance of this forest for the breeding, nesting, shelter, and foraging of many species (Motta-Junior, unpublished data).

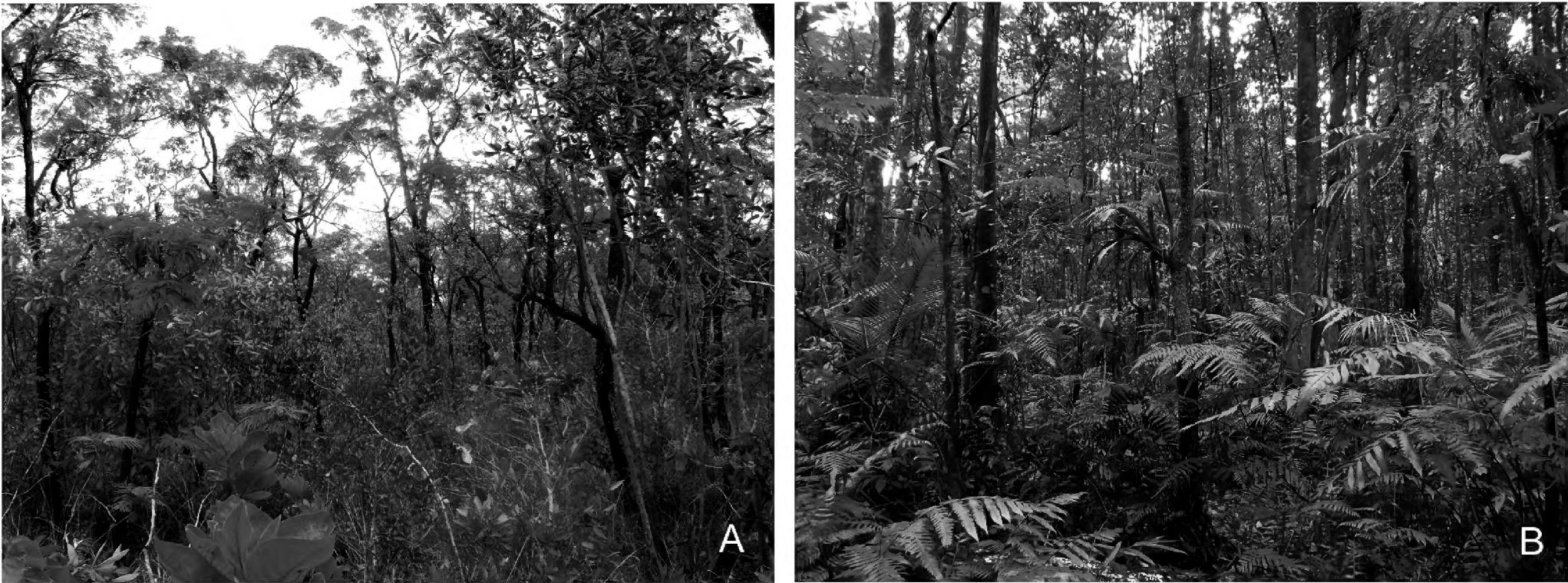


FIGURE 2. A. Cerrado sensu stricto surveyed. B. Riparian forest surveyed. Pictures taken by Pavel Dodonov.

TABLE 1. Cerrado angiosperm species surveyed. *Species not collected; voucher deposited in HUFSCar herbarium.

TAXON	FIGURE	HABIT
Amaranthaceae		
<i>Chamissoa altissima</i> (Jacq.) Kunth	3A	Vine
Anacardiaceae		
<i>Anacardium humile</i> A.St.-Hil.	3B	Shrub
<i>Schinus terebinthifolius</i> Raddi	3C	Tree
<i>Tapirira guianensis</i> Aubl.	-	Tree
Annonaceae		
<i>Annona coriacea</i> Mart.	3D	Shrub
* <i>Annona crassiflora</i> Mart.	-	Tree
<i>Duguetia furfuracea</i> (A.St.-Hil.) Saff.	3E	Shrub
<i>Xylopia aromatica</i> (Lam.) Mart.	3F	Shrub or tree
Apocynaceae		
<i>Forsteronia velloziana</i> (A.DC.) Woodson	3G	Vine
<i>Mandevilla pohliana</i> (Stadelm.) A.H.Gentry	4A	Shrub
<i>Rhodocalyx rotundifolius</i> Müll.Arg.	3H	Shrub
<i>Temnadenia violacea</i> (Vell.) Miers	3I	Vine
Araliaceae		
<i>Schefflera vinosa</i> (Cham. and Schltdl.) Frodin and Fiaschi	4B	Tree
Areceaceae		
<i>Attalea geraensis</i> Barb.Rodr.	-	Palm
<i>Syagrus flexuosa</i> (Mart.) Becc.	-	Palm
Asteraceae		
<i>Achyrocline satureioides</i> (Lam.) DC.	-	Herb
<i>Baccharis dracunculifolia</i> DC.	4C	Shrub
<i>Baccharis linearifolia</i> (Lam.) Pers.	-	Shrub
<i>Calea triantha</i> (Vell.) Pruski	4D	Shrub
<i>Chresta sphaerocephala</i> DC.	4E	Shrub
<i>Clibadium armanii</i> (Balb.) Sch.Bip. ex O.E.Schulz	4H	Herb
<i>Conocliniopsis prasiifolia</i> (DC.) R.M.King and H.Rob.	4F	Herb
<i>Elephantopus angustifolius</i> Sw.	-	Herb
<i>Gamochaeta purpurea</i> (L.) Cabrera	-	Herb
<i>Gochnatia pulchra</i> Cabrera	4G	Shrub
<i>Mikania triangularis</i> Baker	5A	Herb
<i>Piptocarpha rotundifolia</i> (Less.) Baker	4I	Tree
<i>Solidago chilensis</i> Meyen	-	Shrub
<i>Vernonia ferruginea</i> Less.	-	Shrub
<i>Vernonia glabrata</i> Less.	5C	Shrub
<i>Vernonia herbacea</i> (Vell.) Rusby	5D	Shrub
<i>Vernonia platensis</i> (Spreng.) Less.	-	Shrub or tree
<i>Vernonia polyanthes</i> Less.	-	Shrub
<i>Vernonia rubriramea</i> Mart. ex DC.	-	Shrub
<i>Vernonia tweediana</i> Baker	5B	Herb
Bignoniaceae		
<i>Adenocalymma peregrinum</i> (Miers) L.G.Lohmann	5E	Shrub
<i>Amphilophium mansoanum</i> (DC.) L.G.Lohmann	5F	Vine
<i>Anemopaegma arvense</i> (Vell.) Stellfeld ex de Souza	5G	Shrub
<i>Fridericia platyphylla</i> (Cham.) L.G.Lohmann	5H	Shrub or tree
<i>Handroanthus ochraceus</i> (Cham.) Mattos	-	Tree
<i>Jacaranda decurrens</i> Cham.	-	Shrub
<i>Pyrostegia venusta</i> (Ker Gawl.) Miers	5I	Vine
<i>Stizophyllum perforatum</i> (Cham.) Miers	-	Vine

TABLE 1. CONTINUED.

TAXON	FIGURE	HABIT
Bignoniaceae		
<i>*Tabebuia insignis</i> (Miq.) Sandwith	-	Tree
<i>Zeyheria montana</i> Mart.	6A	Shrub or tree
Bixaceae		
<i>Cochlospermum regium</i> (Mart. ex Schrank) Pilg.	-	Shrub
Bromeliaceae		
<i>Aechmea bromeliifolia</i> (Rudge) Baker	-	Herb
<i>Ananas ananassoides</i> (Baker) L.B.Sm.	-	Herb
<i>Bromelia antiacantha</i> Bertol.	6B	Herb
Calophyllaceae		
<i>Kielmeyera coriacea</i> Mart. and Zucc.	6C	Tree
Caryocaraceae		
<i>Caryocar brasiliense</i> Cambess.	6D	Shrub or tree
Celastraceae		
<i>Peritassa campestris</i> (Cambess.) A.C.Sm.	6E	Shrub or tree
Connaraceae		
<i>Connarus suberosus</i> Planch.	6G	Shrub or tree
Convolvulaceae		
<i>Merremia macrocalyx</i> (Ruiz and Pav.) O'Donell	-	Vine
Dilleniaceae		
<i>Davilla elliptica</i> A.St.-Hil.	-	Shrub
<i>Davilla rugosa</i> Poir.	6H	Shrub
Ebenaceae		
<i>Diospyros hispida</i> A.DC.	6I	Tree
Erythroxylaceae		
<i>Erythroxylum campestre</i> A.St.-Hil.	7A	Shrub
<i>Erythroxylum cuneifolium</i> (Mart.) O.E.Schulz	7B	Shrub
<i>Erythroxylum daphnites</i> Mart.	-	Shrub
<i>Erythroxylum pelleterianum</i> A.St.-Hil.	7C	Shrub
<i>Erythroxylum suberosum</i> A.St.-Hil.	7D	Shrub
Euphorbiaceae		
<i>Croton antisiphiliticus</i> Mart.	7E	Shrub
<i>Pera glabrata</i> (Schott) Poepp. ex Baill.	7F	Shrub or tree
<i>Sapium glandulosum</i> (L.) Morong	7G	Shrub or tree
Fabaceae		
<i>Aeschynomene selloi</i> Vogel	7H	Shrub
<i>Anadenanthera peregrina</i> (L.) Speg.	7I	Tree
<i>Andira humilis</i> Mart. ex Benth.	8A	Shrub
<i>*Bauhinia holophylla</i> (Bong.) Steud.	-	Shrub
<i>Bauhinia rufa</i> (Bong.) Steud.	8B	Shrub or tree
<i>Bowdichia virgilioides</i> Kunth	-	Tree
<i>Camptosema ellipticum</i> (Desv.) Burkart	8C	Shrub
<i>Chamaecrista cathartica</i> (Mart.) H.S.Irwin and Barneby	8D	Shrub
<i>Chamaecrista flexuosa</i> (L.) Greene	-	Shrub
<i>Clitoria guianensis</i> (Aubl.) Benth.	-	Shrub
<i>Copaifera langsdorffii</i> Desf.	8E	Tree
<i>Dalbergia miscolobium</i> Benth.	-	Tree
<i>Desmodium barbatum</i> (L.) Benth.	-	Herb
<i>Dimorphandra mollis</i> Benth.	8F	Tree
<i>*Hymenaea stigonocarpa</i> Mart. ex Hayne	-	Tree
<i>Leptolobium dasycarpum</i> Vogel	8G	Shrub
<i>Leptolobium elegans</i> Vogel	8H	Tree
<i>Machaerium acutifolium</i> Vogel	8I	Tree
<i>Machaerium villosum</i> Vogel	-	Tree
<i>Mimosa debilis</i> Humb. and Bonpl. ex Willd.	-	Herb or shrub
<i>Mimosa dolens</i> Vell.	9A	Shrub
<i>Mimosa regnellii</i> Benth.	-	Shrub or tree
<i>Platypodium elegans</i> Vogel	-	Tree

<i>Rhynchosia phaseoloides</i> (Sw.) DC.	9B	Shrub
<i>Senna rugosa</i> (G.Don) H.S.Irwin and Barneby	9C	Shrub
<i>Stryphnodendron adstringens</i> (Mart.) Coville	9D	Tree
<i>Stryphnodendron rotundifolium</i> Mart.	9E	Tree
<i>Stylosanthes guianensis</i> (Aubl.) Sw.	-	Herb
<i>Stylosanthes viscosa</i> (L.) Sw.	9F	Herb
Gentianaceae		
<i>Chelonanthus alatus</i> (Aubl.) Pulle	9G	Herb
Lamiaceae		
<i>Aegiphila verticillata</i> Vell.	9H	Tree
<i>Hypenia glauca</i> (A.St.-Hil. ex Benth.) Harley	9I	Shrub
Lauraceae		
<i>Ocotea pulchella</i> (Nees and Mart.) Mez	10A	Tree
Lythraceae		
<i>Diplusodon virgatus</i> Pohl	-	Shrub or tree
Malpighiaceae		
<i>Banisteriopsis argyrophylla</i> (A.Juss.) B.Gates	10C	Vine
<i>Banisteriopsis campestris</i> (A.Juss.) Little	10D	Shrub
<i>Banisteriopsis laevifolia</i> (A.Juss.) B.Gates	-	Shrub
<i>Banisteriopsis variabilis</i> B.Gates	-	Shrub
<i>Byrsonima coccolobifolia</i> Kunth	10E	Shrub or tree
<i>Byrsonima intermedia</i> A.Juss.	10F	Shrub
<i>Byrsonima verbascifolia</i> (L.) DC.	10G	Shrub or tree
<i>Heteropterys byrsonimiifolia</i> A.Juss.	10H	Shrub
<i>Heteropterys umbellata</i> A.Juss.	10I	Shrub
<i>Mascagnia cordifolia</i> (A.Juss.) Griseb.	-	Vine
<i>Peixotoa tomentosa</i> A.Juss.	11A	Shrub
<i>Stigmaphyllon lalandianum</i> A.Juss.	11B	Vine
Malvaceae		
<i>Eriotheca gracilipes</i> (K.Schum.) A.Robyns	11C	Tree
<i>Luehea grandiflora</i> Mart. and Zucc.	11D	Tree
<i>Waltheria communis</i> A.St.-Hil.	11E	Shrub
Melastomataceae		
<i>Leandra aurea</i> (Cham.) Cogn.	11F	Tree
<i>Miconia albicans</i> (Sw.) Triana	11G	Tree
<i>Miconia ligustroides</i> (DC.) Naudin	11I	Tree
<i>*Miconia rubiginosa</i> (Bonpl.) DC.	-	Tree
<i>Microlicia cordata</i> (Spreng.) Cham.	-	Shrub
<i>Rhynchanthera ursina</i> Naudin	12A	Shrub
<i>*Tibouchina granulosa</i> (Desr.) Cogn.	-	Tree
<i>Tibouchina stenocarpa</i> (Schrank and Mart. ex DC.) Cogn.	12B	Shrub
<i>Trembleya parviflora</i> (D.Don) Cogn.	12C	Shrub
Moraceae		
<i>Brosimum gaudichaudii</i> Trécul	-	Shrub or tree
Myristicaceae		
<i>Virola sebifera</i> Aubl.	12E	Tree
Myrtaceae		
<i>Campomanesia pubescens</i> (DC.) O.Berg	12F	Shrub
<i>Eugenia aurata</i> O.Berg	12G	Tree
<i>Eugenia dysenterica</i> DC.	12H	Tree
<i>Myrcia guianensis</i> (Aubl.) DC.	12I	Tree
<i>Psidium grandifolium</i> Mart. ex DC.	13A	Shrub
Ochnaceae		
<i>*Ouratea nana</i> (A.St.-Hil.) Engl.	-	Shrub
<i>Ouratea spectabilis</i> (Mart.) Engl.	13C	Tree
Onagraceae		
<i>*Ludwigia octovalvis</i> (Jacq.) P.H.Raven	-	Herb
Passifloraceae		
<i>Passiflora cincinnata</i> Mast.	13D	Vine



TABLE 1. CONTINUED.

TAXON	FIGURE	HABIT
Poaceae		
<i>Andropogon bicornis</i> L.	-	Herb
<i>Andropogon leucostachyus</i> Kunth	-	Herb
<i>Melinis minutiflora</i> P.Beauv.	-	Herb
<i>Schizachyrium condensatum</i> (Kunth) Nees	-	Herb
Polygalaceae		
<i>Bredemeyera floribunda</i> Willd.	13E	Vine
Proteaceae		
<i>Roupala montana</i> Aubl.	-	Shrub
Rosaceae		
<i>Rubus brasiliensis</i> Mart.	13I	Shrub
Rubiaceae		
<i>Borreria latifolia</i> (Aubl.) K.Schum.	14A	Herb
<i>Cordia sessilis</i> (Vell.) Kuntze	-	Shrub or tree
<i>Declieuxia fruticosa</i> (Willd. ex Roem. and Schult.) Kuntze	14B	Herb
<i>Guettarda viburnoides</i> Cham. and Schltdl.	-	Tree
<i>Palicourea rigida</i> Kunth	14C	Shrub
<i>Psychotria capitata</i> Ruiz and Pav.	-	Shrub
<i>Psychotria trichophora</i> Müll.Arg.	14E	Shrub
<i>Tocoyena formosa</i> (Cham. and Schltdl.) K.Schum.	14F	Tree
Rutaceae		
<i>Dictyoloma vandellianum</i> A.Juss.	-	Tree
<i>Zanthoxylum rhoifolium</i> Lam.	-	Tree
Salicaceae		
<i>Casearia sylvestris</i> Sw.	14G	Shrub or tree
Sapotaceae		
<i>Pouteria torta</i> (Mart.) Radlk.	-	Tree
* <i>Pradosia brevipes</i> (Pierre) T.D.Penn.	-	Shrub
Solanaceae		
<i>Solanum aculeatissimum</i> Jacq.	-	Herb
<i>Solanum granulosoleprosum</i> Dunal	-	Shrub
<i>Solanum lycocarpum</i> A.St.-Hil.	14H	Shrub or tree
<i>Solanum paniculatum</i> L.	14I	Shrub
<i>Solanum variabile</i> Mart.	15A	Shrub or tree
Styracaceae		
<i>Styrax camporum</i> Pohl	15B	Shrub or tree
Urticaceae		
<i>Cecropia pachystachya</i> Trécul	-	Tree
Verbenaceae		
<i>Lantana camara</i> L.	15C	Shrub
Vitaceae		
<i>Cissus erosa</i> Rich.	15D	Vine
<i>Cissus subrhomboidea</i> (Baker) Planch.	15E	Vine
Vochysiaceae		
<i>Qualea grandiflora</i> Mart.	15F	Tree
<i>Qualea multiflora</i> Mart.	15G	Tree
<i>Vochysia tucanorum</i> Mart.	15H	Tree

The UFSCar reserve had and continues to show very great human influence. It belonged to the old Trancham farm and was burned almost every year for a long time. Nevertheless, the reserve still has a relatively high richness that should be preserved because the site is widely used for research (Francisco and Galetti 2001;

TABLE 2. Species list for the Riparian Forest of Fazzari stream. •Species also collected in cerrado. *Species not collected on the present survey; voucher deposited in HUFSCar herbarium.

TAXON	FIGURE	HABIT
Annonaceae		
<i>Xylopia brasiliensis</i> Spreng.	-	Tree
Araliaceae		
<i>Dendropanax cuneatus</i> (DC.) Decne. and Planch.	-	Tree
Arecaceae		
<i>Euterpe edulis</i> Mart.	-	Palm
Bromeliaceae		
• <i>Aechmea bromeliifolia</i> (Rudge) Baker	-	Herb
Burseraceae		
<i>Protium heptaphyllum</i> (Aubl.) Marchand	-	Tree
Calophyllaceae		
<i>Calophyllum brasiliense</i> Cambess.	-	Tree
Chloranthaceae		
• <i>Hedyosmum brasiliense</i> Mart. ex Miq.	6F	Tree
Euphorbiaceae		
• <i>Pera glabrata</i> (Schott) Poepp. ex Baill.	7F	Shrub or tree
Fabaceae		
• <i>Copaifera langsdorffii</i> Desf.	8E	Tree
• <i>Dalbergia miscolobium</i> Benth.	-	Tree
Lauraceae		
<i>Ocotea odorifera</i> (Vell.) Rohwer	-	Tree
• <i>Ocotea pulchella</i> (Nees and Mart.) Mez	10A	Tree
Magnoliaceae		
<i>Magnolia ovata</i> (A.St.-Hil.) Spreng.	10B	Tree
Melastomataceae		
<i>Miconia chamissois</i> Naudin	11H	Shrub
Meliaceae		
<i>Cabralea canjerana</i> (Vell.) Mart.	-	Tree
<i>Cedrela odorata</i> L.	-	Tree
<i>Guarea guidonia</i> (L.) Sleumer	12D	Tree
Myrtaceae		
• <i>Campomanesia pubescens</i> (DC.) O.Berg	12F	Shrub
<i>Eugenia hiemalis</i> Cambess.	-	Tree
Nyctaginaceae		
<i>Guapira noxia</i> (Netto) Lundell	13B	Tree
Phyllanthaceae		
<i>Hieronyma alchorneoides</i> Allemão	-	Tree
Primulaceae		
<i>Myrsine coriacea</i> (Sw.) R.Br. ex Roem. and Schult.	-	Tree
<i>Myrsine guianensis</i> (Aubl.) Kuntze	13F	Tree
* <i>Myrsine lancifolia</i> Mart.	13G	Tree
<i>Myrsine umbellata</i> Mart.	13H	Tree
Rubiaceae		
<i>Psychotria hoffmannseggiana</i> (Willd. ex Schult.) Müll.Arg.	14D	Shrub
Styracaceae		
• <i>Styrax camporum</i> Pohl	15B	Shrub or tree
Vitaceae		
• <i>Cissus subrhomboidea</i> (Baker) Planch.	15E	Vine
Vochysiaceae		
*• <i>Vochysia tucanorum</i> Mart.	15H	Tree
Winteraceae		
<i>Drimys brasiliensis</i> Miers	15I	Tree



Francisco and Galetti 2002; Oliveira and Batalha 2005). In addition, only a small percentage, approximately 7%, of the native vegetation cover remains in the region of São Carlos. This region has been assigned high priority for the establishment of ecological corridors linking fragments (Rodrigues *et al.* 2008). As the UFSCar reserve has a very rich associated fauna (Barbieri 1992; Roque *et*

al. 2003; Francisco *et al.* 2007) and has native vegetation fragments in its surroundings, its existence is crucial for the establishment of such corridors. Thus, we emphasise the need for preservation because of its importance for not only the academic community of the University campus but also the maintenance of biodiversity in the region.

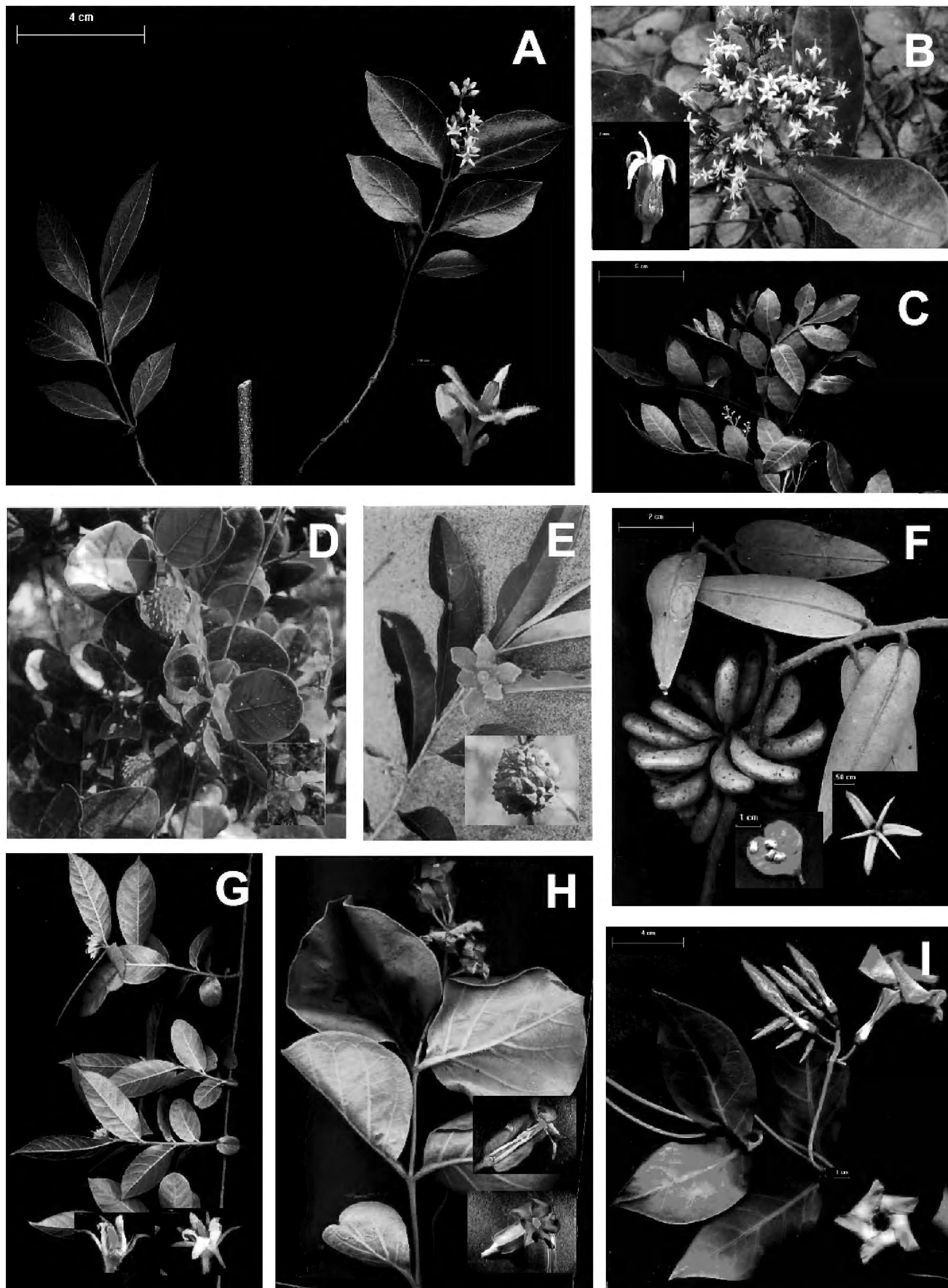


FIGURE 3. Amaranthaceae: A *Chamissoa altissima*, detail. Anacardiaceae: B *Anacardium humile*, flower detail; C – *Schinus terebinthifolius*. Annonaceae: D – *Annona coriacea*, flower and fruit details; E – *Duguetia furfuracea*, fruit detail; F – *Xylopia aromatica*, flower and fruticule details. Apocynaceae: G – *Forsteronia velloziana*, flower details; H – *Rhodocalyx rotundifolius*, flower detail; I – *Temnadenia violacea*, flower detail. Image B: taken by C. Casali.

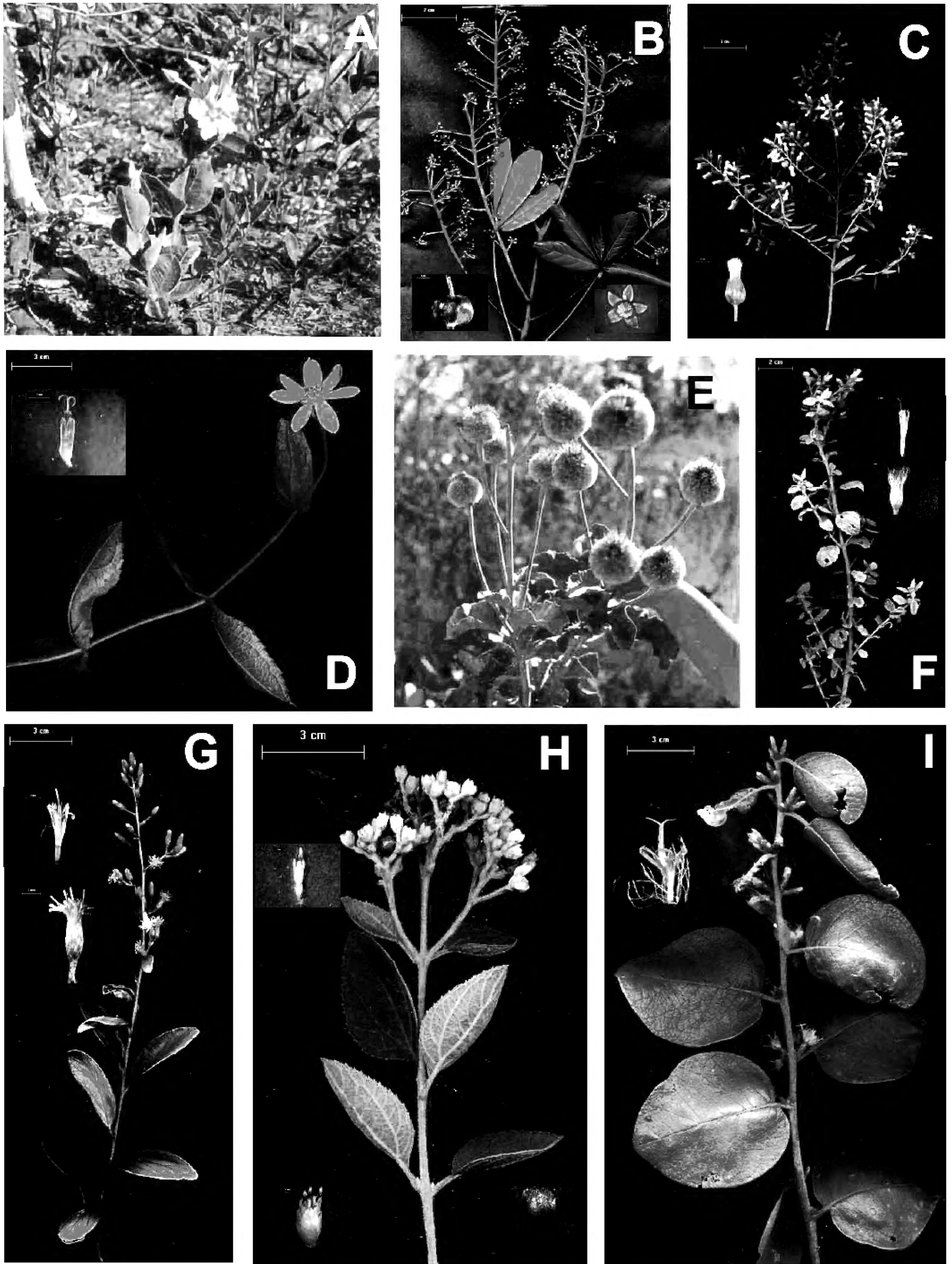


FIGURE 4. Apocynaceae: A *Mandevilla pohliana*. Araliaceae: B *Schefflera vinosa*, and fruit details. Asteraceae: C – *Baccharis dracunculifolia*, inflorescence detail; D – *Calea triantha*, flower detail; E – *Chresta sphaerocephala*; F – *Conocliniopsis prasiifolia*, inflorescence and flower detail; G – *Gochnatia pulchra*, flower and inflorescence details; H – *Clibadium armanii*, flower, inflorescence and fruit details; I – *Piptocarpha rotundifolia*, flower detail.

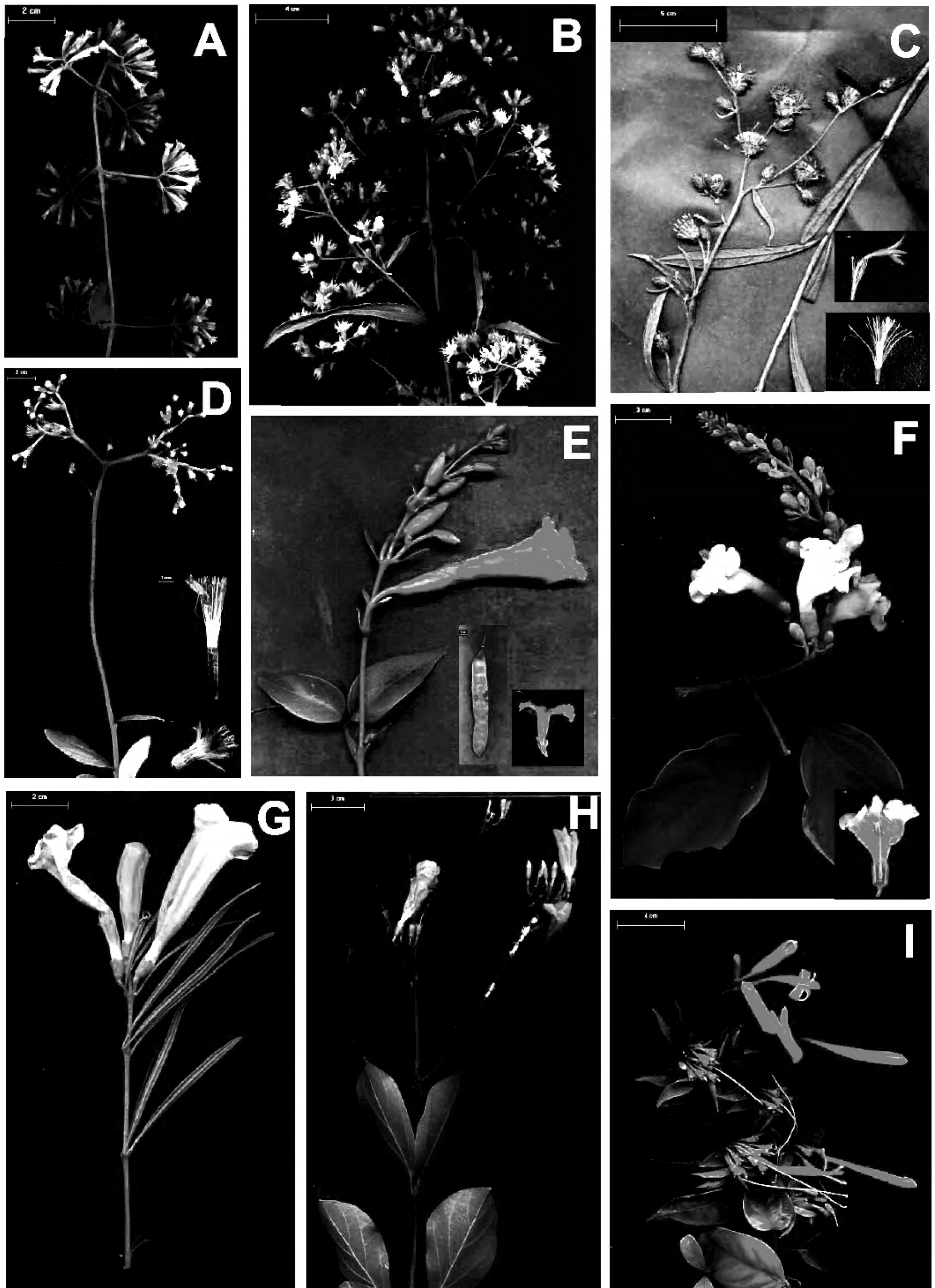


FIGURE 5. Asteraceae: A – *Mikania triangularis*; B – *Vernonia tweediana*; C *Vernonia glabrata*, flower and fruit details; D – *Vernonia herbacea*, inflorescence and fruit details. Bignoniaceae: E – *Adenocalymma peregrinum*, flower and fruit details; F – *Amphilophium mansoanum*, flower detail; G – *Anemopaegma arvense*; H – *Fridericia platyphylla*; I – *Pyrostegia venusta*.

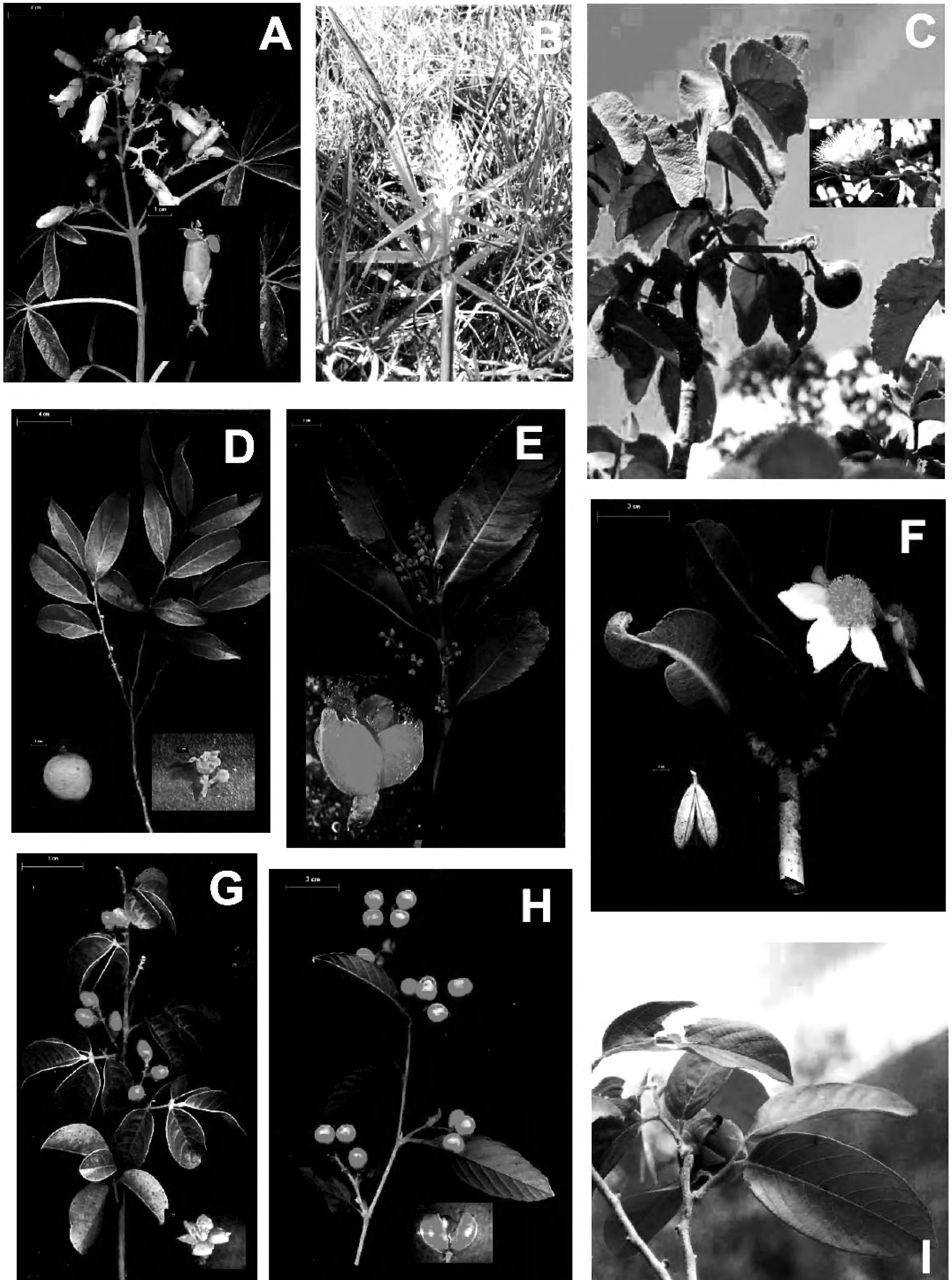


FIGURE 6. Bignoniaceae: A – *Zeyheria montana*, flower detail. Bromeliaceae: B – *Bromelia antiacantha*. Calophyllaceae: C – *Kielmeyera coriacea*, fruit detail. Caryocaraceae: D – *Caryocar brasiliense*, flower detail. Celastraceae: E – *Peritassa campestris*, flower and fruit details. Chloranthaceae: F – *Hedyosmum brasiliense*, female flower detail. Connaraceae: G – *Connarus suberosus*, flower detail. Dilleniaceae: H – *Davilla rugosa*, fruit detail. Ebenaceae: I – *Diospyros hispida*.

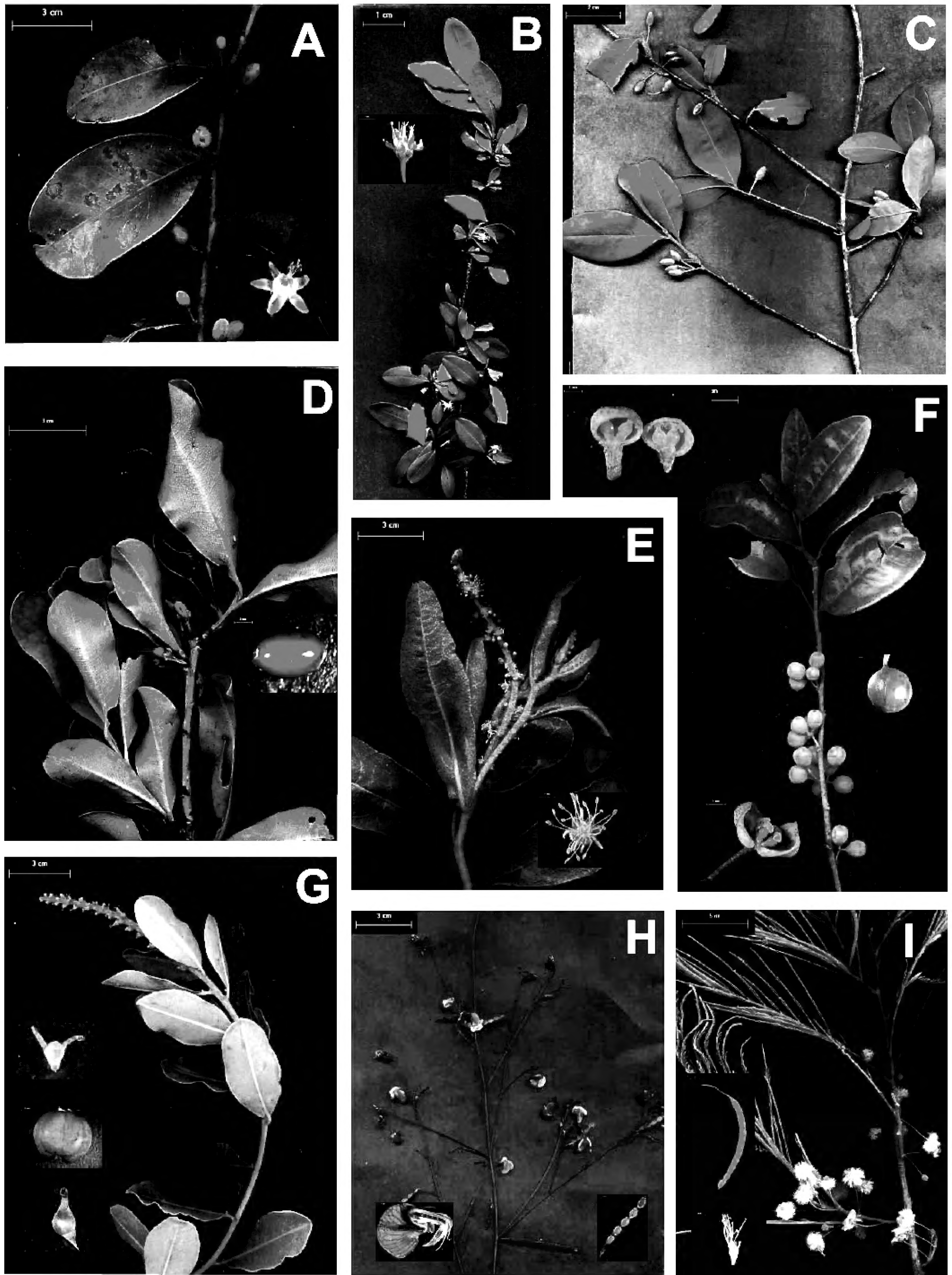


FIGURE 7. Erythroxylaceae: A – *Erythroxylum campestre*, flower detail; B – *Erythroxylum cuneifolium*, flower detail; C – *Erythroxylum pelleterianum*; D – *Erythroxylum suberosum*, fruit detail. Euphorbiaceae: E – *Croton antisiphiliticus*, flower detail; F – *Pera glabrata*, details of fruit and female inflorescences; G – *Sapium glandulosum*, details of fruit and female and male flowers. Fabaceae: H – *Aeschynomene selloi*, flower and fruit details; I – *Anadenanthera peregrina*, flower and fruit details.



FIGURE 8. Fabaceae: A – *Andira humilis*, flower detail; B – *Bauhinia rufa*, fruit detail; C – *Camptosema ellipticum*, flower detail; D – *Chamaecrista cathartica*, flower detail; E – *Copaifera langsdorffii*, flower and fruit details; F – *Dimorphandra mollis*, flower detail; G – *Leptolobium dasycarpum*, flower and fruit details; H – *Leptolobium elegans*, flower detail; I – *Machaerium acutifolium*.



FIGURE 9. Fabaceae: A – *Mimosa dolens*, immature fruit detail; B – *Rhynchosia phaseoloides*, fruit detail; C – *Senna rugosa*, flower and fruit details; D – *Stryphnodendron adstringens*, flower and fruit details; E – *Stryphnodendron rotundifolium*, flower and fruit details. F – *Stylosanthes viscosa*, flower and inflorescence details. Gentianaceae: G – *Chelonanthus alatus*, flower and fruit details. Lamiaceae: H – *Aeghiphila verticillata*, flower and fruit details. I – *Hypenia glauca*, flower detail.

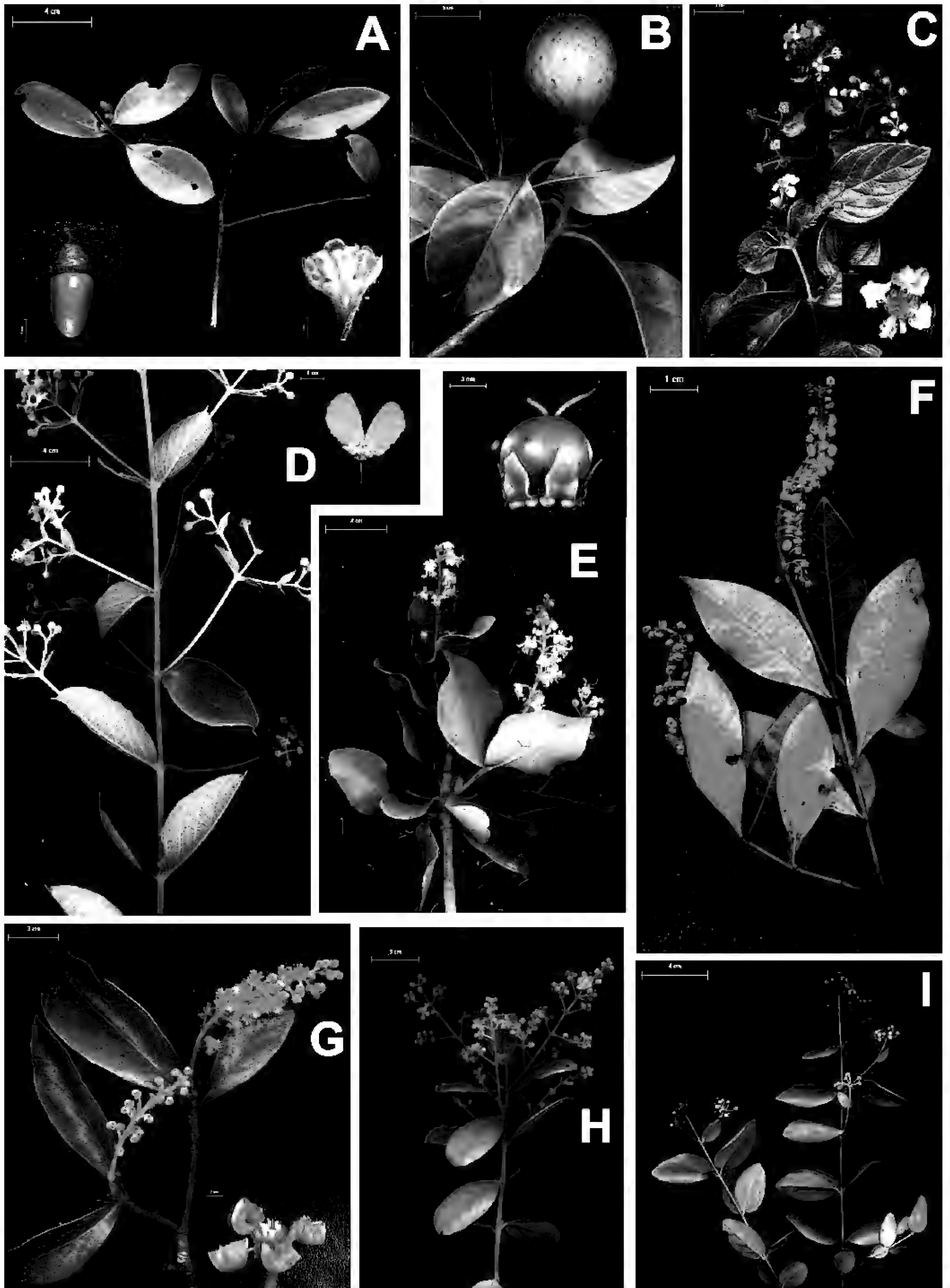


FIGURE 10. Lauraceae: A – *Ocotea pulchella*, flower and fruit details. Magnoliaceae: B – *Magnolia ovata*. Malpighiaceae: C – *Banisteriopsis argyrophylla*, flower detail; D – *Banisteriopsis campestris*, fruit detail; E – *Byrsonima coccolobifolia*, fruit detail; F – *Byrsonima intermedia*; G – *Byrsonima verbascifolia*, flower detail; H – *Heteropterys byrsonimifolia*; I – *Heteropterys umbellata*.

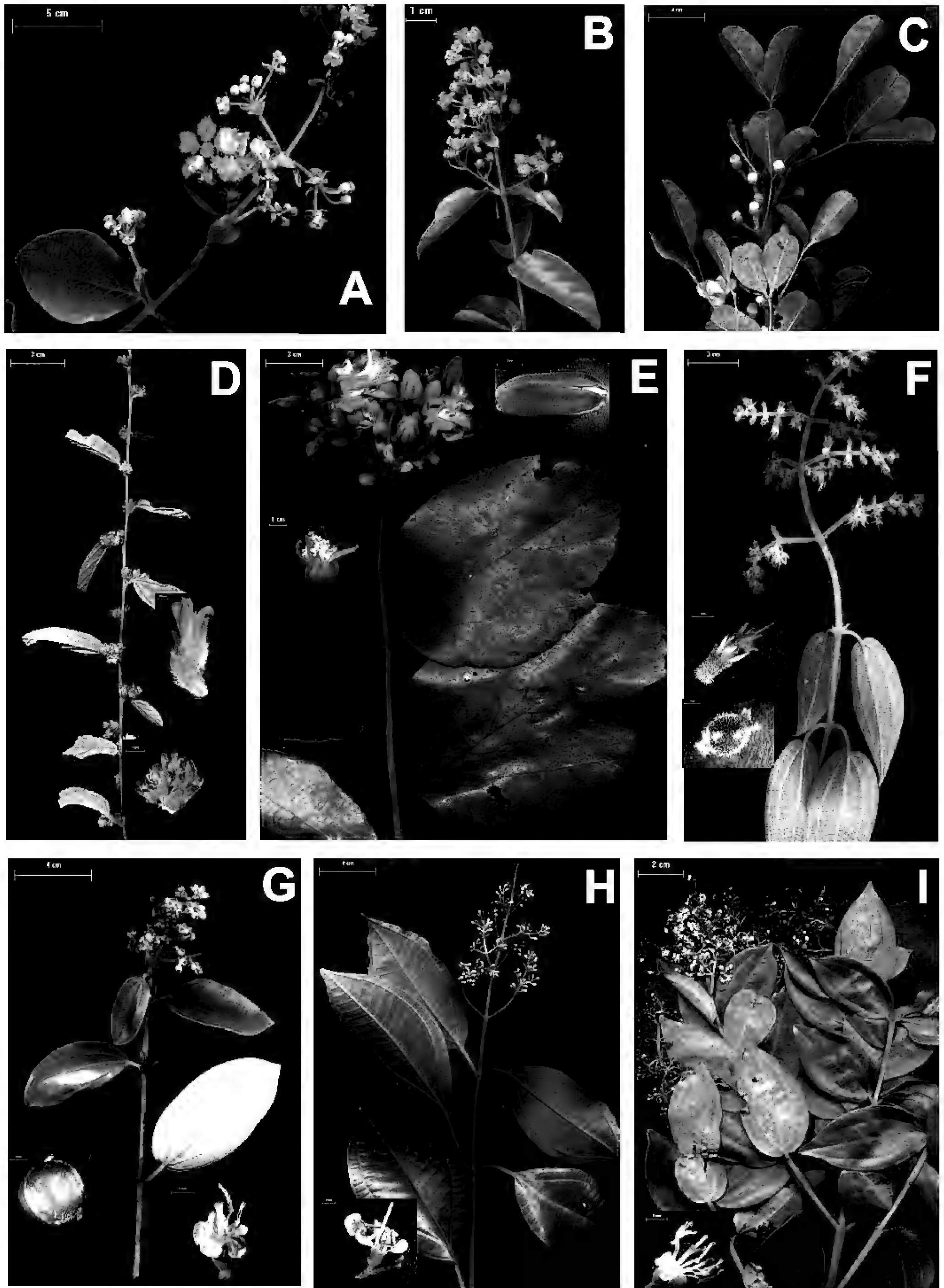


FIGURE 11. Malpighiaceae: A – *Peixotoa tomentosa*; B – *Stigmaphyllon lalandianum*. Malvaceae: C – *Eriotheca gracilipes*; D – *Luehea grandiflora*, flower and fruit details; E – *Waltheria communis*, inflorescence and flower details. Melastomataceae: F – *Leandra aurea*, flower and fruit details; G – *Miconia albicans*, flower and fruit details; H – *Miconia chamissois*, flower detail; I – *Miconia ligustroides*, flower detail.

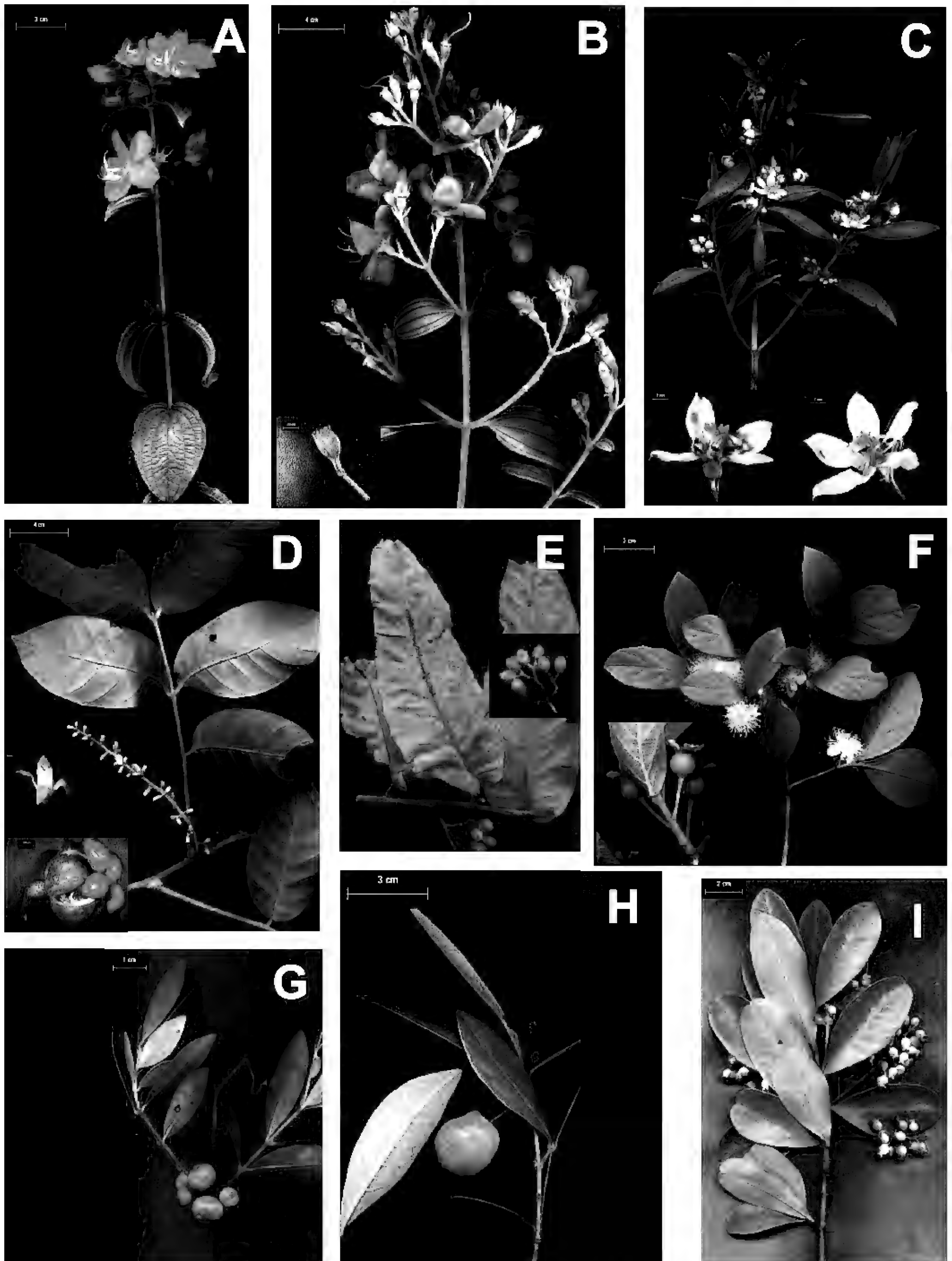


FIGURE 12. Melastomataceae: A – *Rhynchanthera ursina*; B – *Tibouchina stenocarpa*, fruit detail; C – *Trembleya parviflora*, flower details. Meliaceae: D – *Guarea guidonia*, flower and fruit details. Myristicaceae: E – *Virola sebifera*, fruit detail. Myrtaceae: F – *Campomanesia pubescens*, fruit detail; G – *Eugenia aurata*; H – *Eugenia dysenterica*; I – *Myrcia guianensis*.

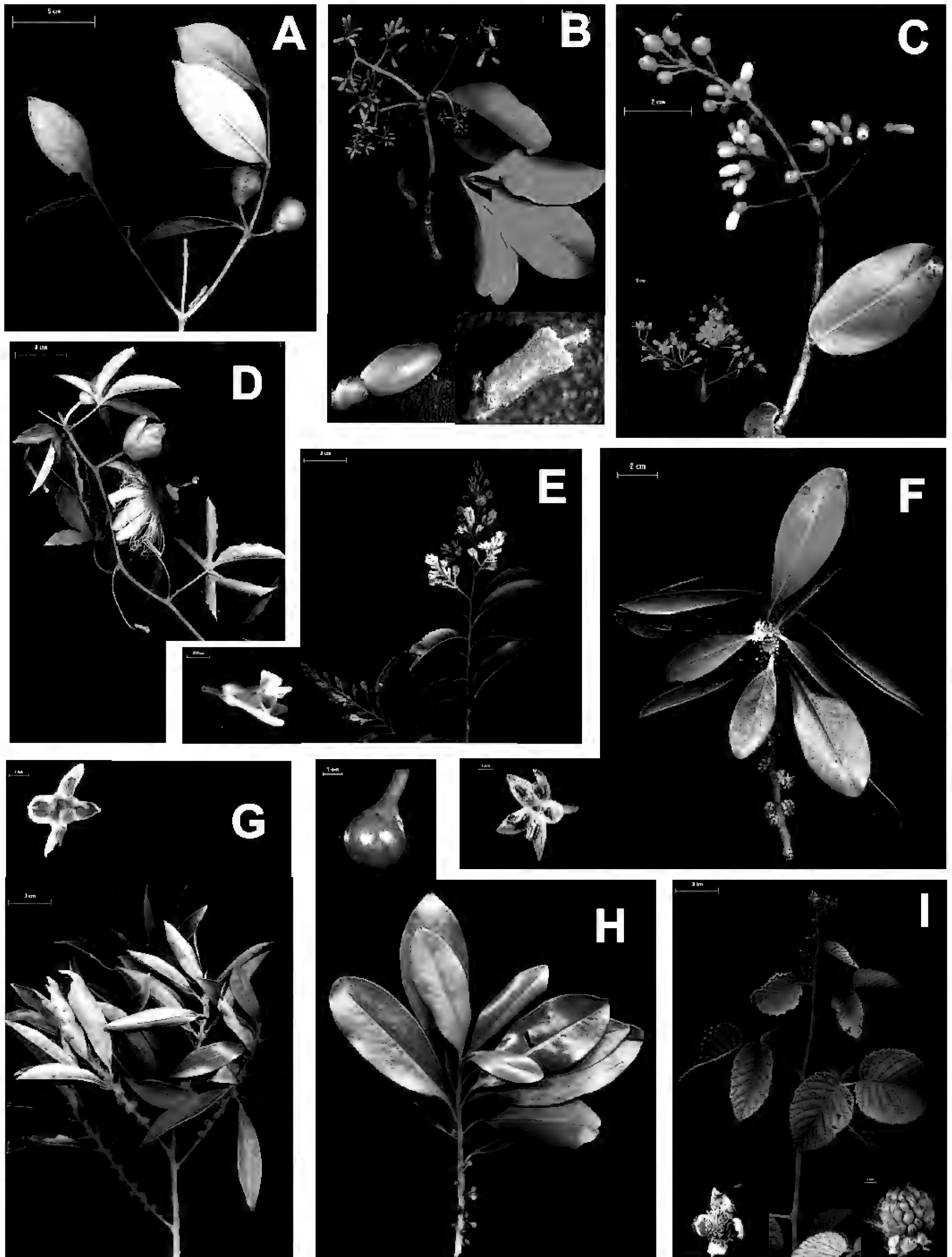


FIGURE 13. Myrtaceae: A – *Psidium grandifolium*. Nyctaginaceae: B – *Guapira noxia*, flower and fruit details. Ochnaceae: C – *Ouratea spectabilis*, inflorescence detail. Passifloraceae: D – *Passiflora cincinnata*. Polygalaceae: E – *Bredemeyera floribunda*, flower detail. Primulaceae: F – *Myrsine guianensis*, flower detail; G – *Myrsine lancifolia*, flower detail; H – *Myrsine umbellata*, fruit detail. Rosaceae: I – *Rubus brasiliensis*, flower and fruit details.

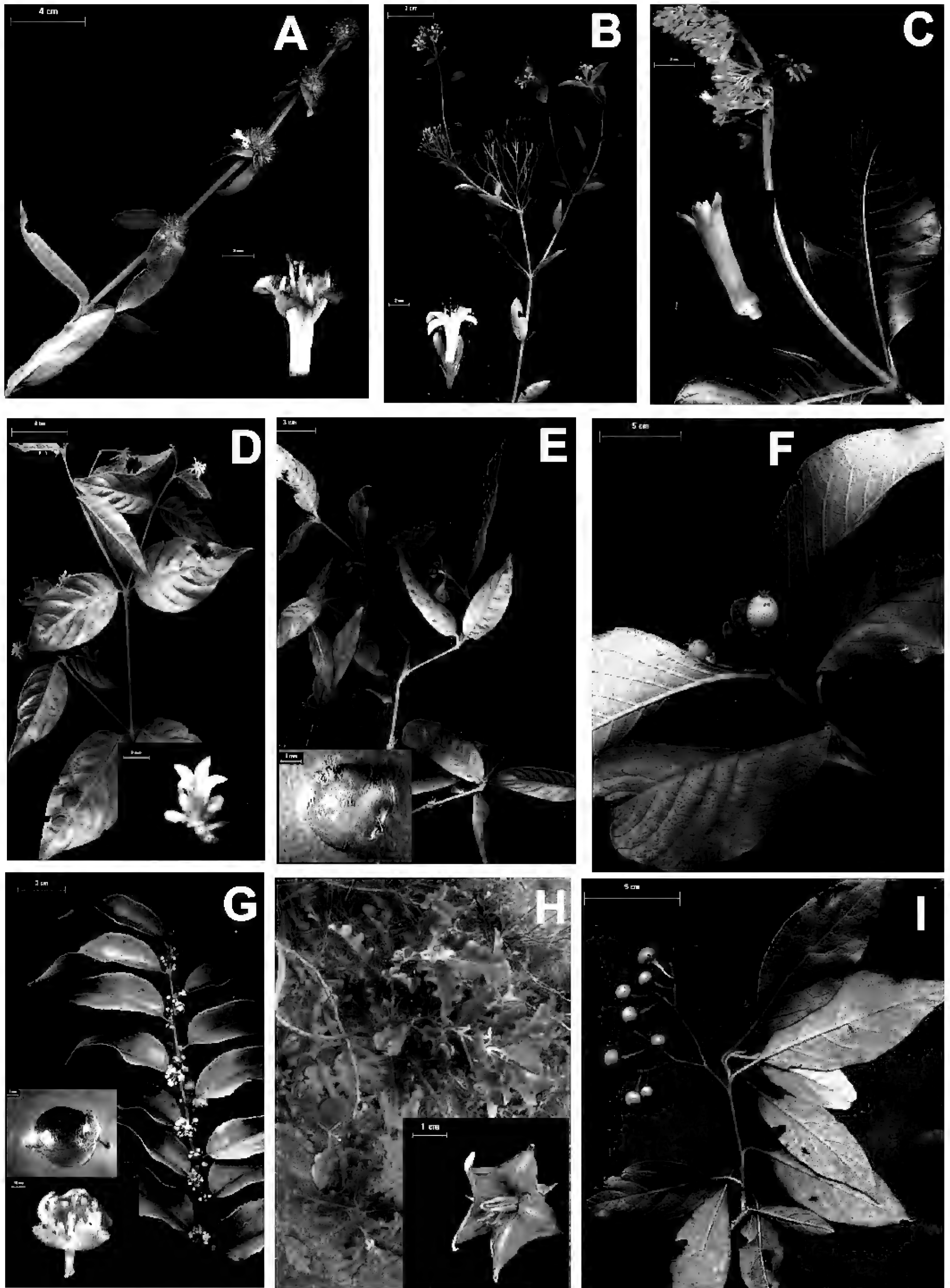


FIGURE 14. Rubiaceae: A – *Borreria latifolia*, flower detail; B – *Declieuxia fruticosa*, flower detail; C – *Palicourea rigida*, flower detail; D – *Psychotria hoffmannseggiana*; E – *Psychotria trichophora*, flower and fruit detail; F – *Tocoyena formosa*. Salicaceae: G – *Casearia sylvestris*, flower and fruit details. Solanaceae: H – *Solanum lycocarpum*, flower detail; I – *Solanum paniculatum*.

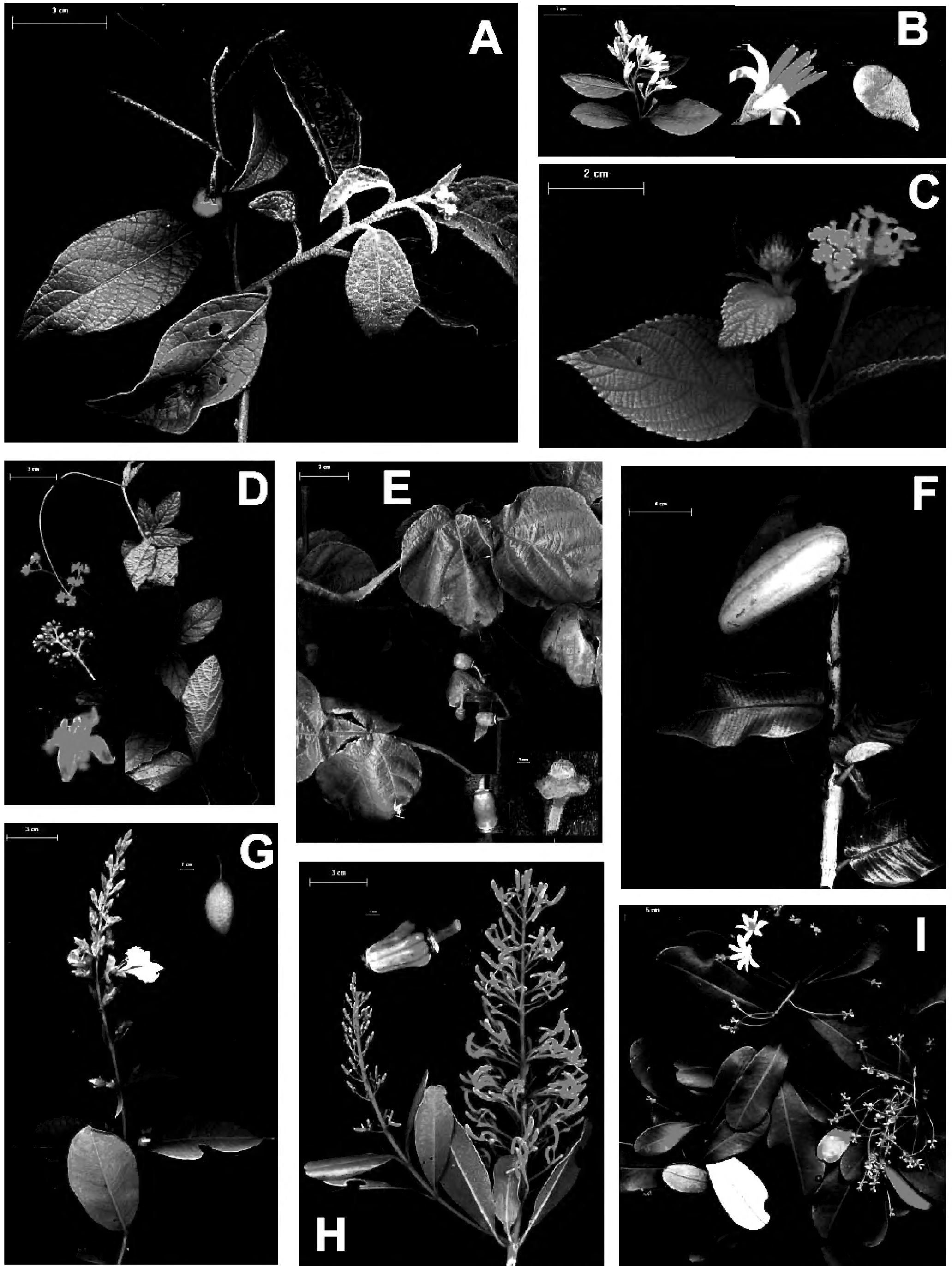


FIGURE 15. Solanaceae: A – *Solanum variabile*. Styracaceae: B – *Styrox camporum*, flower and fruit details. Verbenaceae: C – *Lantana camara*. Vitaceae: D – *Cissus erosa*, flower and fruit details; E – *Cissus subrhomboidea*, fruit detail. Vochysiaceae: F – *Qualea grandiflora*; G – *Qualea multiflora*, fruit detail; H – *Vochysia tucanorum*, fruit detail. Winteraceae: I – *Drimys brasiliensis*.

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LITERATURE CITED

- Almeida, A.M., C.R. Fonseca, P.I. Prado, M. Almeida-Neto, S. Diniz, U. Kubota, M.R. Braun, R.L.G. Raimundo, L.A. Anjos, T.G. Mendonça, S.M. Futada and T.M. Lewinsohn. 2005. Diversidade e ocorrência de Asteraceae em cerrados de São Paulo. *Biota Neotropica* 5(2): 27-43.
- APG III. 2009. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG III. *Botanical Journal of Linnean Society* 161(2): 105-121.
- Barbieri, G. 1992. Dinâmica da Nutrição de *Astyanax scabripinnisparanae* (Characiformes, Characidae) do Ribeirão do Fazzari: São Carlos, SP. *Revista da Sociedade Brasileira de Zootecnia* 21(1): 68-72.
- Carvalho, M.B., K.L. Ishara and R.C.S. Maimoni-Rodella. 2010. Vascular Flora of a Cerrado *sensu stricto* remnant in Pratânia, state of São Paulo, southeastern Brazil. *Check List* 6(3): 350-357.
- Coutinho, L.M. 1978. O conceito de cerrado. *Revista Brasileira de Botânica* 1(1): 17-23.
- Eiten, G. 1972. The cerrado vegetation of Brazil. *Botanical Review* 38(2): 201-341.
- Francisco, M.R. and M. Galetti. 2001. Frugivoria e dispersão de sementes de *Rapanea lancifolia* (Myrsinaceae) por aves numa área de cerrado do Estado de São Paulo, sudeste do Brasil. *Ararajuba* 9(1): 13-19.
- Francisco, M.R. and M. Galetti. 2002. Dispersão de sementes de *Ocotea pulchella* (Lauraceae) por aves numa área de vegetação de cerrado do sudeste brasileiro. *Revista Brasileira de Botânica* 25(1): 11-17.
- Francisco, M.R., V.O. Lunardi and M. Galetti. 2007. Bird attributes, plant characteristics, and seed dispersal of *Pera glabrata* (Schott, 1858), (Euphorbiaceae) in a disturbed cerrado area. *Brazilian Journal of Biology* 67(4): 627-634.
- Haridasan, M. 1998. Solos de Matas de Galeria e Nutrição Mineral de Espécies Arbóreas em Condições Naturais; p. 19-20 *In* J.F. Ribeiro (org.). *Cerrado matas de galeria*. Planaltina: Embrapa.
- Joly, C.A., M.P.M. Aidar, C.A. Klink, D.G. Mcgrath, A.G. Moreira, P. Moutinho, D.C. Nepstad, A.A. Oliveira, A. Pott, M.J.N. Rodal and E.V.S.B. Sampaio. 1999. Evolution of the Brazilian Phytogeography Classification Systems: Implications for Biodiversity Conservation. *Ciência e Cultura Journal of the Brazilian Association for the Advancement of Science* 51(5/6): 331-348.
- Joly, C.A., R.R. Rodrigues, J.P. Metzger, C.F.B. Haddad, L.M. Verdade, M.C. Oliveira and V.S. Bolzani. 2010. Biodiversity conservation research, training, and policy in São Paulo. *Science* 328(5984): 1358-1359.
- Köppen, W. 1948. *Climatología: con un estudio de los climas de la tierra*. Ciudad de México: Fondo de la Cultura Económica. 479 p.
- Mendonça, R.C., J.M. Felfili, B.M.T. Walter, M.C. Silva Júnior, A.V. Rezende, T.S. Filgueiras, P.E. Nogueira and C.W. Fagg. 2008. Flora vascular do Bioma Cerrado: checklist com 12.356 espécies; p. 422-442 *In* S.M. Sano, S.P. Almeida and J.F. Ribeiro (ed.). *Cerrado: ecologia e flora*. Volume 2. Brasília: Embrapa Informação Tecnológica.
- Myers, N., R.A. Mittermeier, C.G. Mittermeier, G.A.B. Fonseca and J. Kent. 2000. Biodiversity hotspots for conservation priorities. *Nature* 403: 853-858.
- Oliveira, F.F. and M.A. Batalha. 2005. Lognormal abundance distribution of woody species in a cerrado fragment (São Carlos, southeastern Brazil). *Revista Brasileira de Botânica* 28(1): 39-45.
- Oliveira-Filho, A.T. and Ratter, J.A. 1995. A study of the origin of Central Brazilian forests by the analysis of plant species distribution patterns. *Edinburgh Journal of Botany* 52:141-194.
- Ratter, J.A., J.F. Ribeiro and S. Bridgewater. 1997. The Brazilian Cerrado vegetation and threats to its biodiversity. *Annals of Botany* 80(3): 223-230.
- Rezende, A.V. 1998. Importância das Matas de Galeria: manutenção e recuperação; p. 1-15 *In* J.F. Ribeiro (org.). *Cerrado matas de galeria*. Planaltina: Embrapa.
- Roque, F.O., M. Peppinelli, E.N. Fragoso, W.A. Ferreira, P.R. Barillari, M.Y. Yoshinaga, S. Trivinho-Strixino, N.F. Verani and M.I.S. Lima. 2003. Ecologia de Macroinvertebrados, Peixes e Vegetação Ripária de um Córrego de Primeira Ordem em Região de Cerrado do Estado de São Paulo (São Carlos, SP); p. 313-338 *In* R. Henry (org.). *Ecótonos das interfaces dos ecossistemas aquáticos*. São Carlos: Rima.
- Rodrigues, R.R., C.A. Joly, M.C.W. Brito, A. Paese, J.P. Metzger, L. Casatti, M.A. Nalon, N. Menezes, N.M. Ivanauskas, V.S. Bolzani and V.L.R. Bononi. 2008. *Diretrizes para conservação e restauração da biodiversidade no Estado de São Paulo*. São Paulo: Governo do Estado de São Paulo. 238 p.
- Secretaria do Meio Ambiente do Estado de São Paulo (SMA-SP). 2007. *Manual operativo do Projeto de Recuperação de Matas Ciliares*. São Paulo: Governo do Estado de São Paulo. 114 p.
- Silva Júnior, M.C., J.M. Felfili, P.E. Nogueira and A.V. Rezende. 1998. Análise Florística das Matas de Galeria no Distrito Federal; p. 52-84 *In* J.F. Ribeiro (org.). *Cerrado matas de galeria*. Planaltina: Embrapa.

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An Illustrated Angiosperm Flora of Cerrado and Riparian Forest, São Carlos, Brazil

Catia Urbanetz^{1*}, Gustavo Hiroaki Shimizu² and Maria Inês Salgueiro Lima³

1 Embrapa Pantanal. Rua 21 de Setembro, 1880. Caixa Postal 109, CEP 79320-900. Corumbá, MS, Brazil.

2 Universidade Estadual de Campinas, Instituto de Biologia, Departamento de Biologia Vegetal, Laboratório de Taxonomia. Rua Monteiro Lobato, 970. Caixa Postal 6109. CEP 13083-970. Campinas, SP, Brazil.

3 Universidade Federal de São Carlos, Centro de Ciências Biológicas e da Saúde, Departamento de Botânica, Laboratório de Sistemática e Ecologia Química. Rodovia Washington Luís, km 235. Caixa Postal 676. CEP 13565-905. São Carlos, SP, Brazil.

* Corresponding author. E-mail: catia.urbanetz@embrapa.br

ERRATUM

PAGE 283, FIGURE 6 should be as follow in the next page.

We regret this error.

May 2013.

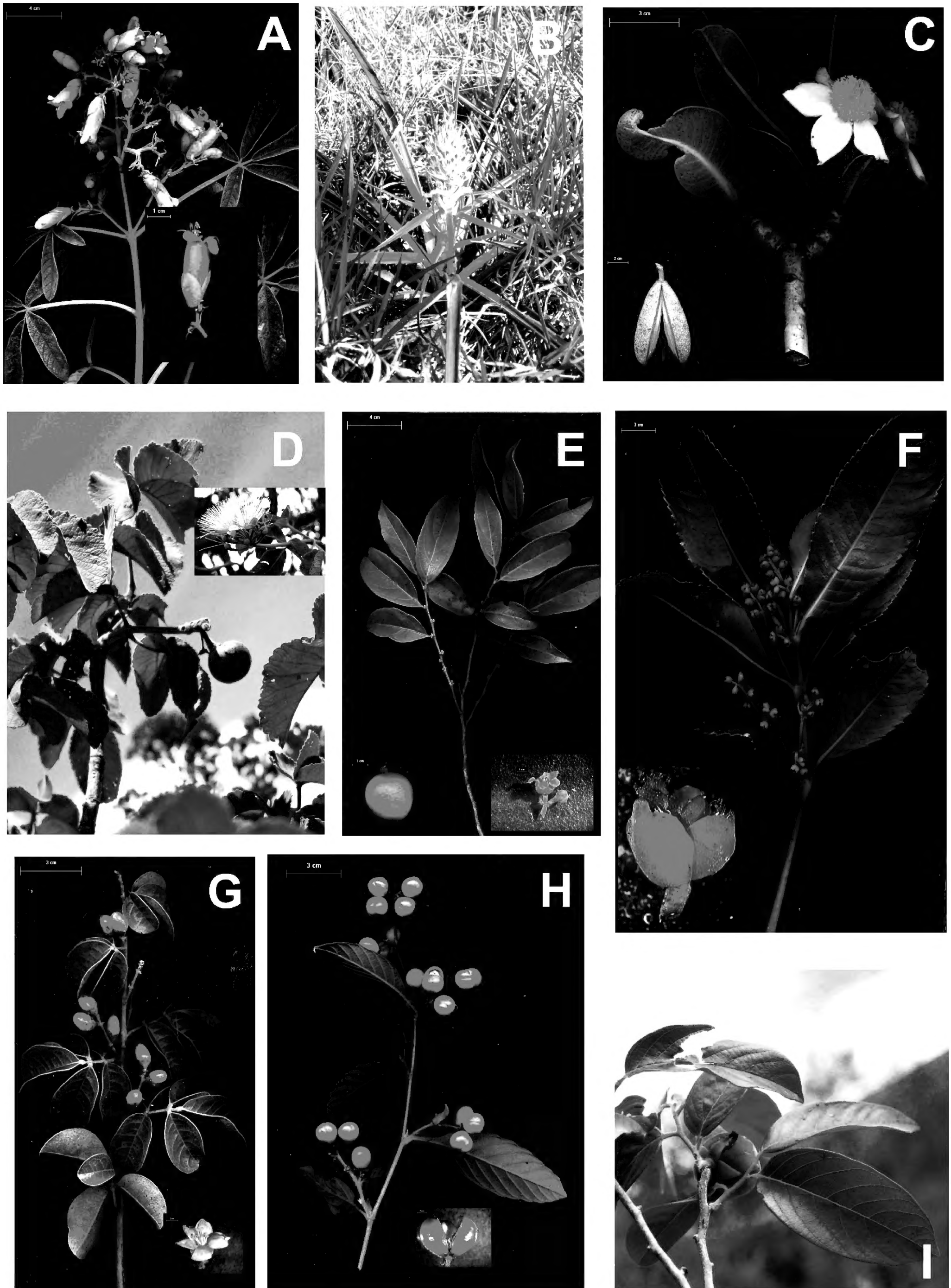


FIGURE 6. Bignoniaceae: A – *Zeyheria montana*, flower detail. Bromeliaceae: B – *Bromelia antiacantha*. Calophyllaceae: C – *Kielmeyera coriacea*, fruit detail. Caryocaraceae: D – *Caryocar brasiliense*, flower detail. Celastraceae: E – *Peritassa campestris*, flower and fruit details. Chloranthaceae: F – *Hedyosmum brasiliense*, female flower detail. Connaraceae: G – *Connarus suberosus*, flower detail. Dilleniaceae: H – *Davilla rugosa*, fruit detail. Ebenaceae: I – *Diospyros hispida*.